Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of:	**)**	
	)	
Biennial Regulatory Review – Amendment of	**)**	
Parts 1, 22, 24, 27 and 90 to Streamline and	**)**	**WT Docket No. 03-264**
Harmonize Various Rules Affecting Wireless	**)**	
Radio Services	**)**	

To: The Commission

COMMENTS OF CROWN CASTLE INTERNATIONAL CORP.

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SUMMARY

Crown Castle International Corp. ("CCI") urges the Commission to adopt a power spectral density ("PSD") (*i.e.*, power per unit of occupied bandwidth) limit for wideband technologies operating in the 1670-1675 MHz band, as an alternative to the current "per carrier" or "per emission" radiated emission limit. Specifically, CCI requests a PSD limit of 4000 watts/MHz EIRP in urban areas and 8000 watts/MHz EIRP in rural areas, limits that still represent significantly *less* power per megahertz of spectrum compared to the power possible under the existing rule for many common narrowband air interface technologies. Because the current power limits provide narrowband technologies with such significant advantages over newer, spectrally-efficient wideband technologies, a PSD-based alternative limit for wideband technologies is necessary to conform with the Commission's stated policy of technology neutrality.

The proposed additional flexibility would provide substantial efficiencies for CCI's planned one-way terrestrial wireless network that will deliver multi-channel digital video and audio programming to mobile phones and other devices, using an advanced technology that employs a 5 MHz channel bandwidth. The proposed limits would result in a 67% to 80% reduction in the number of CCI base stations required to serve a market, permit a faster deployment of service and result in a substantial savings that would translate into a more affordable offering. It would also result in better service with fewer "dead spots," and would significantly improve in-building coverage.

Notably, the change would not result in any increased risk of interference, because the proposal seeks no new radiated emission levels that could not already be achieved using narrowband technologies, and because the interference potential of any signal is more closely dependent on the PSD of the signal than the power per emission. Co-channel operations at three grandfathered Geostationary Operational Environmental Satellite ("GOES") sites will be protected through the use (as already required by the rules) of coordination zones, which may be expanded slightly to ensure full protection from base stations utilizing the proposed new power levels, when analyzed under worst case assumptions. Similarly, adjacent band users will remain protected by existing out-of-band emission ("OOBE") limits which will remain unchanged under the proposal.

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COMMENTS OF
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Crown Castle International Corp. ("CCI") 1/ hereby submits these comments in response to the Commission's *Further Notice* issued in the above-referenced proceeding, which seeks comment on proposals to adopt a power spectral density ("PSD") (*i.e.*, power per unit of occupied bandwidth) limit for wideband technologies, as an alternative to the current "per carrier" or "per emission" radiated emission limit in selected frequency bands. 2/ CCI strongly supports the proposals and, in particular, urges the Commission to establish a PSD-based alternative limit in the 1670-1675 MHz band for wideband technologies. 3/ Such a change would promote the Commission's goal of technology neutrality, as it would lessen the dramatic advantage currently enjoyed by narrowband technologies under existing rules. Moreover, the change would not result

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1/ CCI is one of the world's largest wireless infrastructure companies, with a tower portfolio in the U.S. consisting of over 11,000 towers.

2/ *Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27 and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services*, WT Docket No. 03-264, Report and Order and Further Notice of Proposed Rulemaking, FCC 05-144 (2005) ("*Further Notice*"), *citing* February 7, 2005 *ex parte* of CTIA (recommending that PCS and AW S licensees be provided the option of complying with PSD limits of 3280 watts/MHz EIRP in urban areas and 6560 watts/MHz EIRP in rural areas, in lieu of the current per carrier limit of 1640 watts EIRP in urban areas and 3280 watts EIRP in rural areas).

3/ *See Further Notice* at ¶ 54 (seeking comment on CCI's proposal originally presented in its May 16, 2005 *ex parte* submitted in this proceeding).

in any increased risk of interference to: (1) the three grandfathered co-channel Geostationary Operational Environmental Satellite ("GOES") sites, due to the use of coordination zones; or (2) to adjacent band users, who are protected by emission ("OOBE") limits which will remain unchanged under the proposal.

I. Background

CCI is the parent of OP Corporation, which in Auction 46 obtained a nation-wide license for the 1670-1675 MHz band, governed by the Commission's Part 27 rules for Wireless Communications Services. CCI, through its Crown Castle Mobile Media subsidiary, is using the spectrum to deploy a terrestrial wireless network that will transmit multiple channels of high-quality, digital video and audio programming to mobile phones and other hand-held devices. 4/ The CCI network will be a one-way wireless network using Digital Video Broadcasting-Handheld ("DVB-H") technology. DVB-H is a wideband, Orthogonal Frequency Division Multiplexing ("OFDM")-based technology which is a recognized global standard for mobile television. As an open standard, DVB-H has been formally adopted both by the industry standards-setting consortium, Digital Video Broadcasting Project ("DVB"), and by the European Telecommunications Standards Institute (ETSI). CCI already has arrangements with equipment manufacturers such as Nokia, Motorola, and Samsung to produce handsets that tune to the 1670-1675 MHz band and that incorporate DVB-H receiver technology. In fact, CCI and Nokia recently completed successful technology demonstration trials in Pittsburgh, and CCI is now conducting a market trial of its proposed service, using its commercial-grade network currently operating in that city. As CCI works toward the national deployment of its network, however, it is confronted by efficiency-reducing technical rules that require CCI – due to its choice of this

4/ CCI plans to wholesale its service to wireless carriers and other service providers, who will offer it to their customers on a subscription basis.

advanced, new, wideband technology – to build significant numbers of additional base stations for no apparent interference protection or other public interest reasons. 5/

II. Technology Neutrality Requires a PSD-Based Emission Limit

As the *Further Notice* recognizes, the current rules create a disparity between narrowband and wideband technologies, as the same maximum radiated power limit applies, regardless of how much information (*i.e.*, voice or data) is transmitted within one emission. Comparing CDMA to TDMA or GSM technologies as examples, the *Further Notice* notes that "a wide emission system is allowed to provide only about one-fifth of the radiated power for each voice conversation that a narrow emission system is allowed to provide." 6/ In fact, the disparity is even more striking for CCI's chosen technology, which uses a single five-megahertz channel per base station. The radiated emission limit for the 1670-1675 MHz band is 2000 watts EIRP, 7/ which calculates to only 400 Watts per MHz when spread over one five megahertz emission. By contrast, if CCI were deploying its network using a narrowband technology such as GSM or GPRS/EDGE, it could accommodate as many as 25 channels within its five megahertz of spectrum. Therefore, the narrowband approach could result in the emission at any given CCI base station, of 25 times more energy (or 10,000 Watts per MHz) than CCI's chosen wideband technology.

5/ Due to the recent nature of the DVB-H standardization work, CCI and other parties could not have raised this issue in the service rules proceeding for the 1670-1675 MHz band (WT Docket No. 02-8), which was commenced in early 2002. As the Commission noted, "sometimes … an FCC rule adopted under earlier unknown or different technological circumstances will inadvertently affect new and evolving technologies unequally …." *Further Notice* at ¶ 56. Such is the case here.

6/ *Further Notice* at ¶ 58.

7/ 47 C.F.R. § 27.50(f).

The Commission has adopted PSD limits in other contexts, where it recognized that a simple maximum EIRP limit would advantage narrowband over wideband technologies. For example, in adopting a PSD limit for the 70/80/90 GHz bands, the Commission acknowledged that, without a PSD limit, narrowband applications would be able to extend their range beyond that of wideband applications. 8/ The Commission reached a similar conclusion in adopting PSD-based limits for the new Wireless Broadband Service at 3650 MHz, finding that a narrower bandwidth application could operate over distances five time greater than systems using a very wide-bandwidth technology. 9/

The *Further Notice* reiterates the Commission's long-held objective of developing "technology neutral" rules. 10/ Indeed, this objective was prominent in the development of the *Service Rules Order* for the 1670-1675 MHz band, where the Commission stated its intent to adopt a "technology-neutral approach that will allow licensees to implement a broad range of services and technologies. … [W]e do not believe that the public interest would be served if we were to adopt technical requirements that would tend to favor one technology over another." 11/ Specifically, with regard to the power limits for the band, the Commission also stated that:

8/ *Allocations and Service Rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands*, WT Docket No. 02-146, Memorandum Opinion and Order, FCC 05-45 (rel. Mar. 3, 2005) at ¶ 39.

9/ *Wireless Operations in the 3650-3700 MHz Band*, ET Docket No. 04-151, Report and Order and Memorandum Opinion and Order, FCC 05-56 (rel. Mar. 16, 2005) at n.102 ("For free space propagation, distance is proportional to the square of the distance or in terms of decibels distance doubles for each additional 6 dB of power. Because 25 watts is 14 dB more than 1 watt (*i.e.*, $10\log_{10}25=14$), a system operating with 25 watts over 1 megahertz of bandwidth would have the ability to successfully operate over distances approximately five times larger than a system that spreads 25 watts of power over 25 megahertz of bandwidth.").

10/ *Further Notice* at ¶ 56.

11/ *Amendments to Parts 1, 2, 27 and 90 of the Commission's Rules to License Services in the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands*, Report and Order, 17 FCC Rcd 9980 (May 24, 2002) ("*Service Rules Order*") at ¶ 125.

> Because we do not know what technologies will eventually be deployed in these bands, we prefer to adopt an approach that will allow licensees to implement a broad range of services and technologies. As we have previously stated, we do not want to set [power] limits that will . . . offer one type of technology an advantage over another. 12/

To achieve this objective, the power limits for the 1670-1675 MHz band should be amended. CCI requests that the Commission establish a PSD-based alternative limit for wideband systems in the band that is proportional to the limit proposed by CTIA for the PCS and AWS services (*i.e.*, using § 27.50(f)'s 2000 Watts EIRP as a starting point, rather than the 1640 Watts EIRP found in the PCS and AWS rules). CCI thus requests an alternative PSD limit of 4000 watts/MHz EIRP in urban areas and 8000 watts/MHz EIRP in rural areas for wideband systems 13/ in the 1670-1675 MHz band. Notably, these requested PSD limits represent significantly *less* power per megahertz of spectrum compared to the power possible under the existing rule for many common air interface technologies. For example, GSM/GPRS/EDGE interfaces (200 kHz channels) are permitted 10,000 Watts/MHz; TDMA and AMPS interfaces (30 kHz channels) are permitted 66,400 Watts/MHz; and the iDen interface (25 kHz channels) is permitted 80,000 Watts/MHz. Thus, it would be misleading to characterize the requested change as a power increase for the band; rather, the change would merely lessen the considerable power advantage enjoyed by narrowband vis-à-vis wideband technologies.

The *Further Notice* asked what "marginal benefit" could be achieved by the maximum power levels being proposed, and whether they are needed for routine operations or

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12/ *Service Rules Order* at ¶ 134.

13/ CCI takes no position on whether the definition for a wideband system should be based on a 500 kHz or 1 MHz emission bandwidth. *Further Notice* at ¶ 61. Because CCI is deploying a network based on 5 MHz channels, it will properly be classified as a wideband system under either definition.

only in extraordinary situations. 14/ CCI's network would be able to take advantage of the full PSD limits for the vast majority of its sites. The use of the proposed limits for CCI's deployment would provide significant benefits, as it would increase the coverage area of a 1670-1675 MHz base station by three to five times. This would equate to a 67% to 80% reduction in the number of base stations required to serve a market, permit a faster deployment of service and result in a substantial savings that would translate into a more affordable offering. It would also result in better service with fewer "dead spots," and would significantly improve in-building coverage.

CCI notes that the needs of one-way, broadcast-type networks are very different from the needs of cellular-type networks. The former do not require reverse path links, so there is no concern about system "imbalance," where a base station transmits to points so far out that a mobile unit located at those points would not have adequate power to respond to the base station. In addition, the cellular-type network approach for frequency reuse and providing system *capacity* is not the same as that for broadcast-type systems. Cellular-type networks transmit different information from each base station to serve its market, whereas broadcast-type systems transmit the same information from base stations to serve its market. Thus, broadcast-type systems can directly benefit from higher powered use in all market types, without the same concerns regarding potential interference to neighboring systems and base stations that can arise with cellular-type networks. Accordingly, CCI's network will be able to utilize the new power limits much more efficiently and more pervasively than cellular networks. Thus, even if the Commission determined that the maximum limits requested for the PCS and AWS bands were not fully justified, there would be no reason for it to reach such a conclusion for the 1670-1675 MHz band.

14/ *Further Notice* at ¶ 63.

Stepped Approach vs. Linearly-Scaled PSD Limits. The *Further Notice* sought comment on whether the Commission should develop "stepped limits" by establishing maximum EIRP limits in a table divided into categories of emission bandwidths, rather than the "sliding scale" approach proposed by CTIA. 15/ CCI does not believe that a pure, linearly-scaled PSD limit would be overly-complex to administer, as it involves a simple multiplication of a PSD limit by the emission bandwidth. 16/ Given that it would not necessarily be linearly-scaled, a stepped approach would not go as far as a simple PSD limit in leveling the playing field between narrowband and wideband technologies. 17/ It would also provide less flexibility; the limits would be "chosen as appropriate to the technologies commonly deployed in that emission bandwidth," 18/ so future technologies or technologies not commonly deployed in a particular bandwidth category could end up with inappropriate limits.

Nevertheless, a stepped approach could potentially provide adequate flexibility, depending on the specific values contained in the table. Significantly, however, the maximum emission levels shown as examples in Tables 1 and 2 of the *Further Notice* would *not* provide CCI with the flexibility it needs, and would not go far enough in leveling the playing field with respect

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15/ *Further Notice* at ¶ 62.

16/ CCI agrees that sliding scales for highway speed limits based on vehicle weight, an analogy used in the *Further Notice*, would be impractical, as both drivers and law enforcement agents would have to continually and quickly make new calculations to determine proper speeds based on different roads with different speed limits. Communications engineers, however, will have plenty of time to make the simple calculations for proper EIRP settings before transmitters are deployed, and there would only be two possible "speed limits" – one for rural and one non-rural.

17/ Wideband 5 MHz technologies under this proposed approach would still be disadvantaged by many dB as compared to narrowband technologies operating under the current rules.

18/ *Further Notice* at ¶ 63.

to narrowband technologies. 19/ Even if these PCS-band values were increased upward to reflect the higher 2000 Watt EIRP "starting point" for the 1670-1675 MHz band, the value in Table 2 for a 5 MHz emission bandwidth technology is 4 dB less than the alternative PSD limit CCI is seeking. Moreover, CCI's 5 MHz channel would be allowed only twice the EIRP that a 1.25 MHz CDMA channel could use, although CCI would be occupying four times the amount of spectrum to serve its customers. If the Commission does adopt a tabular approach to setting the EIRP limits for the 1670-1675 MHz band, it should include a separate category for emission bandwidths of 5 MHz or more, with maximum EIRP limits of 20,000 Watts non-rural, and 40,000 Watts rural.

Increased PSD Limits in Rural Areas. Moreover, CCI's request for a higher power limit in rural areas is consistent with recent Commission precedent. In 2004, the Commission allowed 100 percent base station power increases for PCS and Advanced Wireless Service ("AWS") carriers operating in rural areas. 20/ The reasoning provided by the Commission for increasing the base station power limits applicable to rural PCS and AWS operations also applies to rural 1670-1675 MHz operations. 21/ A power increase in rural areas will facilitate the deployment of CCI services into rural areas, as fewer base stations will be required, thereby bringing the cost-per-pop of deploying service closer to the cost incurred in more densely populated areas, and increasing the economic justification for extending service to rural areas.

19/ *Further Notice* at ¶¶ 62-63 (suggesting EIRP-limit tables and seeking comment on the appropriate power levels for the various emission bandwidths).

20/ *Facilitating the Provision of Spectrum-Based Services to Rural Telephone Companies to Provide Spectrum-Based Services*, WT Docket No. 02-381, Report & Order, 19 FCC Rcd 19078 (2004) at ¶¶ 99, 101. The term "rural areas" is defined as counties with a population density below 100 persons per square mile. *Id.* at ¶ 11.

21/ *See id.* at ¶ 96 ("we believe that this modification of our PCS regulations will allow licensees to increase their coverage while using fewer base stations, thereby reducing the costs of providing service to rural areas").

Promotion of Advanced Spectrally-Efficient Technologies. Finally, the requested alternative power limits will help encourage the use of advanced, spectrally efficient technologies such as wideband OFDM-based technologies. CCI's DVB-H will use enhanced convolutional coding techniques, robust digital video compression and coding techniques, and a single frequency network (SFN) or N=1 channel re-use scheme, which is extremely spectrally efficient, as it uses the entire spectrum that is available at all sites. 22/

III. The Proposed PSD Limits Will Not Result in Increased Interference Potential; Government Users Will Remain Fully Protected

A. Interference Potential Is Governed by PSD, Not Power Per Emission

The proposal to implement an alternative PSD limit will not result in any greater risk of interference compared to the current rules. Indeed, the proposal seeks no new radiated emission levels that could not already be achieved using narrowband technologies. 23/ Thus, there is no need to be concerned about additional interference potential. 24/ The interference potential of any signal is more closely dependent on the PSD of the signal than the power per emission. The Commission recently noted this fact in its order adopting rules for the 3650 MHz band, stating that "interference potential is directly related to a device's EIRP density." 25/ It is not surprising, then, that PSD is the common

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22/ In addition, CCI's technology will use Multi-Protocol Encapsulation Forward Error Correction ("MPE-FEC") and low-noise amplifiers in mobile receivers that have the ability to demodulate multiple signals in difficult radio environments, again optimizing the use of spectrum.

23/ In fact, it is the higher total power that can be produced by narrowband technologies that most increases the likelihood of interference. For example, under the current rule a receiver employing a 5 MHz bandwidth can potentially receive power from 166 TDMA co-channels simultaneously, resulting in 332,000 Watts of power into a victim receiver, far more than the 40,000 Watts that would be possible from a 5 MHz bandwidth technology under CCI's proposal.

24/ *See Further Notice* at ¶¶ 61, 65.

25/ *Wireless Operations in the 3650-3700 MHz Band*, ET Docket No. 04-151, Report and Order and Memorandum Opinion and Order, FCC 05-56 (rel. Mar. 16, 2005) at ¶ 50.

metric used for the analysis of interference potential to services that are co-channel or adjacent to 1670-1675 MHz, such as GOES, radiosondes and radio astronomy operations. 26/

B. Coordination Zones Will Protect Co-Channel Government Operations

The only co-channel operations occurring in the 1670-1675 MHz band are the grandfathered GOES earth stations at three sites around the country: Wallops Island, Virginia; Fairbanks, Alaska and Greenbelt, Maryland (a back-up facility to Wallops Island, used only about once per month). Section 1.924(g)(1) of the Commission's rules establishes coordination zones around these three sites and requires that licensees planning to construct and operate within such zones notify the National Oceanic and Atmospheric Administration ("NOAA") of their planned operations and coordinate their operations with NOAA to ensure that the GOES sites are protected. 27/ Section 27.903(b)(3) requires the Commission licensee in the 1670-1675 MHz band to file a separate station application with the Commission prior to constructing and operating any station subject to Section 1.924. 28/ CCI takes seriously its obligation to protect these three government sites through the use of close coordination, and CCI has already conducted a study with NOAA to address concerns it may have with CCI's PSD-based emission limit proposal.

Under the current rules, the coordination zones for Wallops Island and Fairbanks each consists of an area bounded by a circle with a radius of 100 kilometers centered on those sites; for Greenbelt, the radius of the zone is 65 kilometers. 29/ Based on CCI's review of data from a preliminary interference analysis prepared under the auspices of NOAA, it appears that *even if*

26/ For example, International Telecommunication Union ("ITU") interference criteria are specified in terms of PSD for the protection of the GOES earth station receivers.

27/ 47 C.F.R. § 1.924(g)(1). Licensees are required to protect GOES operations at Wallops Island and Fairbanks at all times, and licensees are required to protect GOES operations at Greenbelt only when the Greenbelt site is active. 47 C.F.R. § 1.924(g)(2).

28/ 47 C.F.R. § 27.903(b)(3).

29/ 47 C.F.R. § 1.924(g)(1).

worst case assumptions are made, only minor increases to the coordination zone sizes are needed when operating at the PSD limit requested, and only at the Greenbelt and Fairbanks sites.

The NOAA-sponsored analysis assumed that all CCI base station antennas would be located 260 feet above ground level and would operate with maximum power pointed in the direction of the GOES receiver sites. 30/ In reality, however, CCI will likely use sites in the coordination zones with lower base station antenna heights and directional antennas that do not point toward the GOES receivers, thus offering more isolation in the direction of the victim receiver sites. Nevertheless, propagation maps that have been generated based on the NOAA's worst case assumptions (attached hereto as exhibits) show the various coordination zone contours that would be needed for each site, pursuant to the PSD limits requested, and include: (1) the currently-permitted power limit of 2 kW EIRP; (2) the requested alternative limit of 4 kW/MHz EIRP for non-rural areas; and (3) the requested alternative limit of 8 kW/MHz EIRP for rural areas. As illustrated by these worst case analyses for the highest power case, the radius of the coordination zone for Greenbelt would be only have to be extended from 65 kilometers to 100 kilometers, and the radius of the coordination zone for Fairbanks would only have to be extended from 100 kilometers to 180 kilometers under these assumptions. No change would be needed for the Wallops Island coordination zone, even for the highest power case, as Section 1.924(g) currently requires coordination to 100 km for this facility. CCI will continue to work with NTIA and NOAA to administer any appropriate expansions of the coordination zones for its base stations that utilize the proposed new power levels to ensure full protection for the co-channel GOES sites.

30/ In addition, the NOAA analysis represents a worse-case analysis that does not include any propagation clutter losses for land-use or tree foliage, and assumes perfectly aligned antenna polarizations.

C. *Adjacent Band Government Operations Would Continue to be Protected Because the Applicable Out-of-Band Emission Limit Would Remain Unchanged*

Radio astronomy, space research (passive) and radiosonde operations may occur in the bands immediately adjacent to the 1670-1675 MHz band. None of these operations would be negatively affected by CCI's proposal, however, because no changes in the OOBE limits applicable to 1670-1675 MHz operations are being proposed. When the Commission established the OOBE limits contained in Section 27.53(j), it indicated that such limits, and coordination requirements set forth in Section 1.924 of the Commission's rules, would be sufficient to protect the adjacent band systems. 31/ The change in power limits sought through CCI's PSD-based proposal should have no discernable impact on any of the adjacent band operations in view of the fact that the applicable OOBE limit, contained in Section 27.53(j), would not be altered. CCI has already been assured by its equipment manufacturer that, with the use of enhanced filtering and power amplifier techniques, its base station transmitters will be able to comply with the existing OOBE limit when operating at the power levels being requested. In addition, it should be noted that any new base station equipment must undergo FCC type acceptance prior to use, serving as further assurance that the current OOBE limits will be met.

Finally, CCI notes that is not seeking any change in the rules established to protect radio astronomy operations in West Virginia. Section 1.924(a) creates a coordination zone around the radio astronomy facilities at Green Bank and Sugar Grove, West Virginia, and Section 27.903(b)(3) requires that separate station applications be filed and approved before 1670-1675 MHz sites can be operated within this zone. 32/ The continued presence of these requirements

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31/ *Service Rules Order* at ¶¶ 123, 135.

32/ *See* 47 C.F.R. §§ 1.924(a), 27.903(b)(3).

reinforces the conclusion that the instant proposal will have no discernable impact on adjacent band operations.

Conclusion

Consistent with its well-established policy of technological neutrality, the Commission should adopt the alternative PSD limits proposed by CCI for the 1670-1675 MHz band. Adoption of the requested limits would enable CCI, as the licensee in the 1670-1675 MHz band, to deploy its chosen wideband technology rapidly and efficiently, without facing the competitive inequality created by the current maximum EIRP limit. The PSD limits requested by CCI would result in power levels per megahertz far below those permitted under the current rule for common narrowband technologies, including GSM, TMDA and iDEN. Because no change in the OOBE limit is being requested, adjacent channel users would continue to be protected, and protection of the three co-channel GOES sites would be ensured through close coordination with NOAA and the development of new coordination zone boundaries, to the extent needed, that take account of the new PSD limits.

Respectfully Submitted,

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December 19, 2005

EXHIBITS

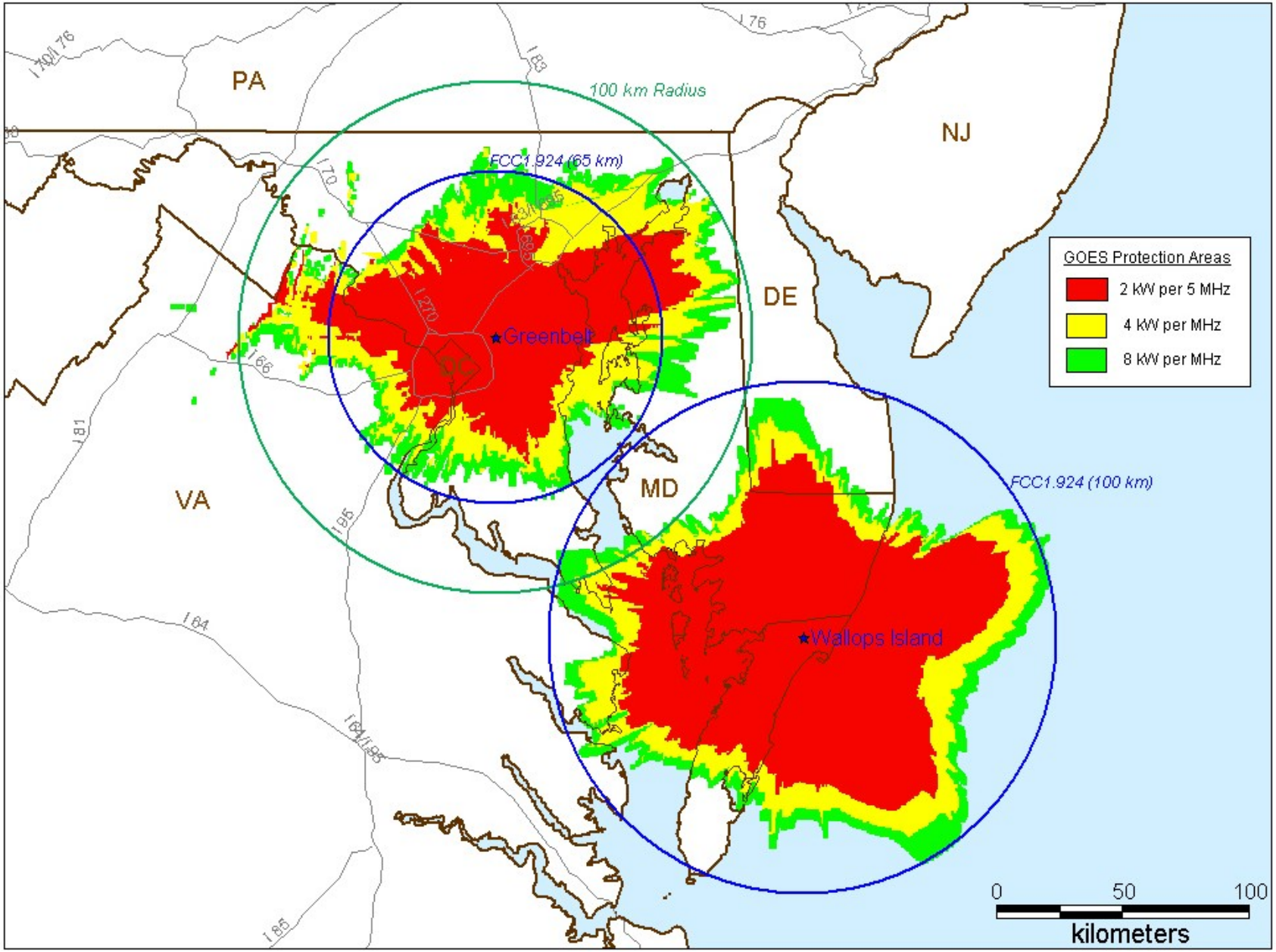

Figure 1. Preliminary NOAA-sponsored Interference Coordination Analysis – Wallops Is., VA & Greenbelt, MD

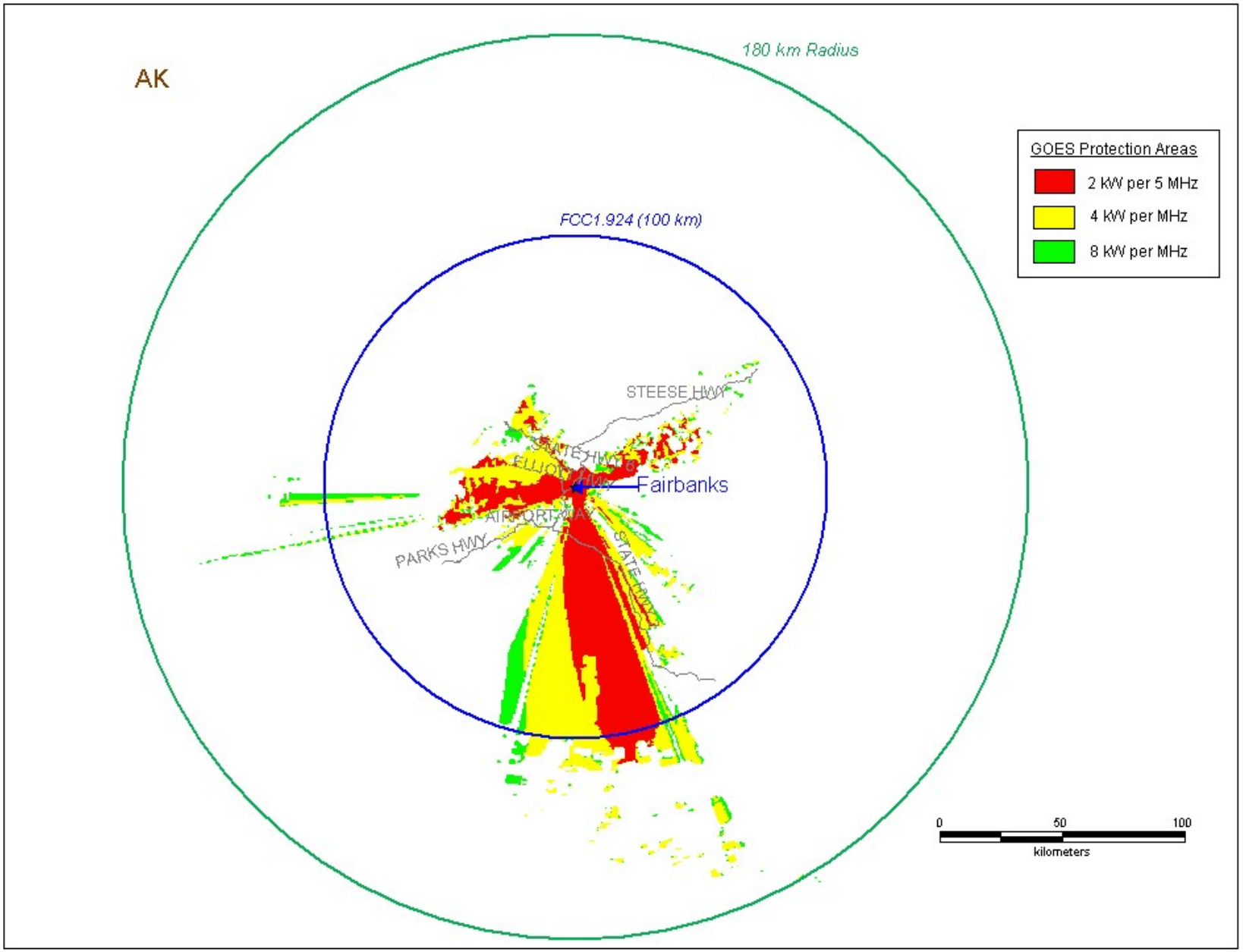

Figure 2. Preliminary NOAA-sponsored Interference Coordination Analysis – Fairbanks, AK